A CASE OF "POLLINIA" (a)

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Recently while studying the pollen of Sarcolaena multiflora Dup. Ehs., a member of the Chlaenaceae, the author noticed that the grains were large and were deeply sculptured in a most curious manner. Between the sculpturings could be seen the outlines of a number of spherical objects.

Upon being shown a specimen, Dr. Paul B. Sears suggested that it might be a pollinium of sixteen grains, all enclosed within the thick and sculptured wall. Further study proved this to be the case.

A search into the literature for information or references concerning the pollen of this family revealed the notation from Engler and Prantl that the pollen grains are comparatively large, that their form is, in all species examined, uniform and spherical, and that they have six deep furrows crossing their surface. Tetrads are arranged according to the angles of furrows (b).

The only cases of pollinia recorded in the literature were those of the Orchidaceae, Asclepiadaceae, Mimosae, and Acaciae. In these cases of pollinia there are usually 8, 16, 64, or hundreds of pollen grains which are united by a waxy substance. There is no mention of a special covering around the mass or any consistent numbers of cells concerned. In some cases the contents of the whole locule of the anther has been united.

A condition similar to the one found by the writer is the so-called "tetrad", a condition in which 4 cells are within a common wall or are united with various degrees of firmness. These have been reported by various workers in the following plant groups: many species of Orchidaceae, in the Ericaceae (Erica, Calluna, Menziesia, and Andromeda), in the Epacridaceae (Epacris and Leucopogon). Other genera are Arctostaphylos, Arbutus, Rhododendron, Ledum, Vaccinium, Juncus, Jacquinia, Luzula, Anona, Drimys, Jussiaea, Periploca, Fourcroya, and Typha.

Upon request, Dr. H. Humbert of Paris sent eight additional species of the Chlaenaceae, including six genera. An examination of this material revealed that a similar condition existed in all of these species. In four species the pollen grains are in quartets (see figs. 1, 2, 5, and 8), the degree of union of the members of the quartet varying from a condition where a heavy sculptured wall encloses the four cells to a condition where the four cells are only

TABLE I.

Data concerning the pollen of the members of the Chlaenaceae examined in this study.

Pollen of:	Diameter in mu	Number of cells	Description
Eremolaena rotundifolia	90	4	Common wall thick, not sculptured in regular fashion.
Eremolaena Humblotiana	117	4	Common wall with at least 4 wide deep furrows, wall papillate along margin.
Leptolaena multiflora	73	16	Tetrad separated by heavy partition, common wall sculptured.
Rhodolaena Bakeriana	109.5	16	Tetrads very distinct, common wall very thin, not sculptured. Cells bulge walls out.
Rhodolaena parviflora	45	4	No outer wall, members of tetrads separated easily.
Sarcolaena codonochlamys	127.4	16	Outer wall heavy.
Sarcolaena multiflora	101	16	Like above, tetrads very distinct.
Schizolaena cauliflora	40	4	Rather easily separated into single grains
Xerochlamys Bojeriana	80	16	Common wall rather thick. Crystals in walls.
Xylolaena Richardii	135	16	Members of tetrads rather firmly united, may be surrounded by a common wall.

slightly coherent.

The remaining species have compound grains composed of 16 cells. The outer wall of these compound structures is quadrisected by six deep furrows (fig. 11a). Each of the four portions of the wall thus formed covers a quartet of cells.

Such a condition could have resulted if the members of the tetrads formed during sporogenesis had undergone two more divisions and all the cells thus formed had remained within the spore-mother cell wall. The descendants of members of the original tetrad would form quartets enclosed within the wall which probably formed about each member of the original tetrad before the next divisions occurred. Thus the sixteen cells are grouped into four quartets, each quartet distinct from the other three quartets.

The members of each quartet are arranged so that three cells are against the outer wall and one is in the center (fig. 11c). The three cells against the outer wall thus form in general outline a triangle. The deep furrows mentioned above pass between adjacent quartets (fig. 11a) and the areas between the furrows are also triangular. Each triangular portion of the outer wall fits over a quartet like a cap (fig. 11b).

The compound grain might be said to be quadriseptate, since the wall of the cells which divided to form the members of each quartet is discrete and definitely separates the quartets from one another.

The outer wall which covers the four quartets probably represents the modified spore-mother cell wall.

The width of the furrows varies with the water content of the structure. When the cells are turgid, the furrows are wide, when dried, narrow.

The word pollinia undoubtedly was not coined to designate as complex or highly organized structures as have just been described. Kerner and Oliver, in their Natural History of Plants, give the following definition of a pollinium, "The resultant mass of pollen cells formed when the pollen of one Archesporium remain united into a tissue". Webster's New International Dictionary definites it simply as, "A coherent mass of pollen grains".

A new term to more aptly describe these structures seems desirable. The term, pollen tetraquartet, although a little awkward, describes the true condition well, as will be seen from the description above (c).

Table I gives the data concerning the members of the family examined in this study.

The ancestral type of this family apparently arose on the island of Madagascar and for some reason remained in a small area on the island. Tracing the evolution of the present types on the basis of pollen morphology may be done, although some steps in the process may be missing. If we ar-

range the species according to complexity we arrive at this series:

Rhodolaena parviflora, simple quartet, easily separated.
Schizolaena cauliflora, simple quartet, rather easily separated.
Eremolaena rotundifolia, single quartet, surrounded by a common unsculptured wall.
Eremolaena Humblotiana, single quartet, surrounded by a thick sculptured wall.
Xylolaena Richardii, four quartets, common wall unmodified.

Leptolaena multiflora, Rhodolaena Bakeriana, Sarcolaena codonochlamys, Sarcolaena multiflora, and Xerochlamys Bojeriana would then culminate the series as the most complex on the basis of pollen morphology.

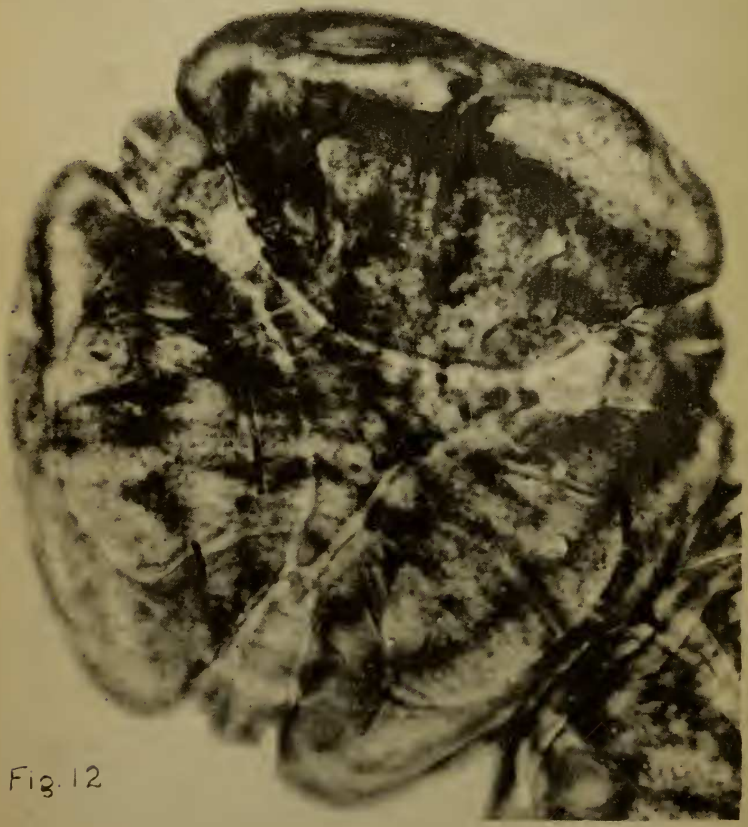

Fig. 12

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig.7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Explanation of Figures

Figures 1 to 10 inclusive, photomicrographs by the author, made with Spencer Microscope Model 44. Figure 11 photographed by Theodore Kibby.

Fig. 1. Pollen quartet of Eremolaena rotundifolia P. Danduy, X 180.

Fig. 2. Pollen quartet of Eremolaena Humblotiana H. Bn., X 115.

Fig. 3. Pollen tetraquartet of Leptolaena multiflora Du Petit Thouars, X 160.

Fig. 4. Pollen tetraquartet of Rhodolaena Bakeriana H. Bn., X 145.

Fig. 5. Pollen quartet of Rhodolaena parviflora F. Gerard, X 215.

Fig. 6. Pollen tetraquartet of Sarcolaena codonochlamys Baker, X 140.

Fig. 7. Pollen tetraquartet of Sarcolaena multiflora Dup. Ehs., X 185.

Fig. 8. Pollen quartet of Schizolaena cauliflora Dup. Ehs., X 290.

Fig. 9. Pollen tetraquartet of Xerochlamys Bojeriana H. Bn., X 180.

Fig. 10. Pollen tetraquartet of Xylolaena Richardii H. Bn., X 105.

Fig. 11. Clay model of pollen tetraquartet of Rhodolaena Bakeriana H. Bn.; a. one cell; b. rim of cap; c. bulge in cap due to cell beneath.

Fig. 12. Pollen tetraquartet of Sarcolaena multiflora Dup. Ehs., X 780.

(a) Contribution from the Botanical Laboratory of the University of Oklahoma, No. 29.

(b) Die natürlichen Pflanzenfamilien, III Teil, 6 Abteilung.

(c) Sharp (Lester W., An introduction to cytology. New York. Ed. 3. 1934. Page 250), it seems to us wisely, has advocated the use of the term quartet to designate four cells formed by division of a mother cell and limited the term tetrad to the univalent groups of chromosomes present previous to the formation of separating cells.